JOHNSON CONTROLS

*Powered by* **Eaton's Cutler-Hammer Technology**

# N2 and XT BUS Communication

User Manual

March 2006
Supersedes January 2006


*VSD IntelliPass*


*VSD Open*

*VSD Enclosed Intellipass w/DX-9100*

March 2006

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Cover Photo: Johnson Controls VSD Series Drives.

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# Safety

## Definitions and Symbols

**⚠ WARNING**

This symbol indicates high voltage. It calls your attention to items or operations that could be dangerous to you and other persons operating this equipment. Read the message and follow the instructions carefully.

⚠

This symbol is the "Safety Alert Symbol." It occurs with either of two signal words: CAUTION or WARNING, as described below.

**⚠ WARNING**

Indicates a potentially hazardous situation which, if not avoided, can result in serious injury or death.

**⚠ CAUTION**

Indicates a potentially hazardous situation which, if not avoided, can result in minor to moderate injury, or serious damage to the product. The situation described in the CAUTION may, if not avoided, lead to serious results. Important safety measures are described in CAUTION (as well as WARNING).

## Hazardous High Voltage

**⚠ WARNING**

Motor control equipment and electronic controllers are connected to hazardous line voltages. When servicing drives and electronic controllers, there may be exposed components with housings or protrusions at or above line potential. Extreme care should be taken to protect against shock.

Stand on an insulating pad and make it a habit to use only one hand when checking components. Always work with another person in case an emergency occurs. Disconnect power before checking controllers or performing maintenance. Be sure equipment is properly grounded. Wear safety glasses whenever working on electronic controllers or rotating machinery.

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# Chapter 1 — Overview

## Introduction

The Johnson Controls VSD Series Drives powered by Cutler-Hammer® technology from Eaton's electrical business can be controlled, monitored and programmed from a host system via Johnson Controls N2 or XT BUS communication protocols with the addition of the VS-OPTNX RS-485 Communication Option Board.

If you purchase your Communication Board separate from the drive, please note that it must be installed in slot D or E on the control board of the VSD Series drive.

## Specifications

**Table 1-1: Specifications**

| Item | Specification |
|---|---|
| **Communication Board Connections** | |
| Interface | VS-OPTNX: Pluggable connector (5.08 mm) |
| Data Transfer Method | RS-485, half-duplex |
| Communication Bus | 3-wire (Twisted pair + Reference) shield optional ① |
| Electrical Isolation | 500V DC |
| **Communications** | |
| Johnson Controls N2 Bus | As described in Metasys N2 System Protocol Specification |
| Johnson Controls XT Bus | As described in Metasys System 9100 Protocol Specification |
| Baud Rate | 9600 baud |
| Addresses | 1 to 247 |
| **Environment** | |
| Ambient Operating Temperature | 14 to 131°F (-10 to 55°C) |
| Storage Temperature | -40 to 140°F (-40 to 60°C) |
| Humidity | <95%, non-condensing |
| Altitude | Max. 3280 ft. (1000m) |
| Vibration | 0.5G at 9 to 200 Hz |
| **Safety** | |
| Standards | Fulfils EN 50178 standard |
| Certification | CE, UL |

① The N2/XT Bus is a "daisy chain" communications line. It consists of three wires for the following signals: +, –, and Common. The + and – lines carry the actual data signals. The Common line provides a reference so that each connected device is capable of electrically receiving and transmitting data by creating a common voltage reference among all the devices connected together over the communication bus. Three conductors are required. It is important that the + and – lines are twisted together, which allows most induced noise (common-mode noise) from external sources to affect both lines equally, thereby canceling the noise. In most installations, the communication bus works fine with unshielded cable. However, in noisy environments, shielded twisted wire must be used.

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# Chapter 2 — Board Layout and Connections

The VS-OPTNX RS-485 Communication Board is connected to the communications bus through a 5-pin pluggable bus connector.

Communication with the control board of the drive takes place through the standard Interface Board Connector (see **Figure 2-1**).

## VS-OPTNX Communication Board

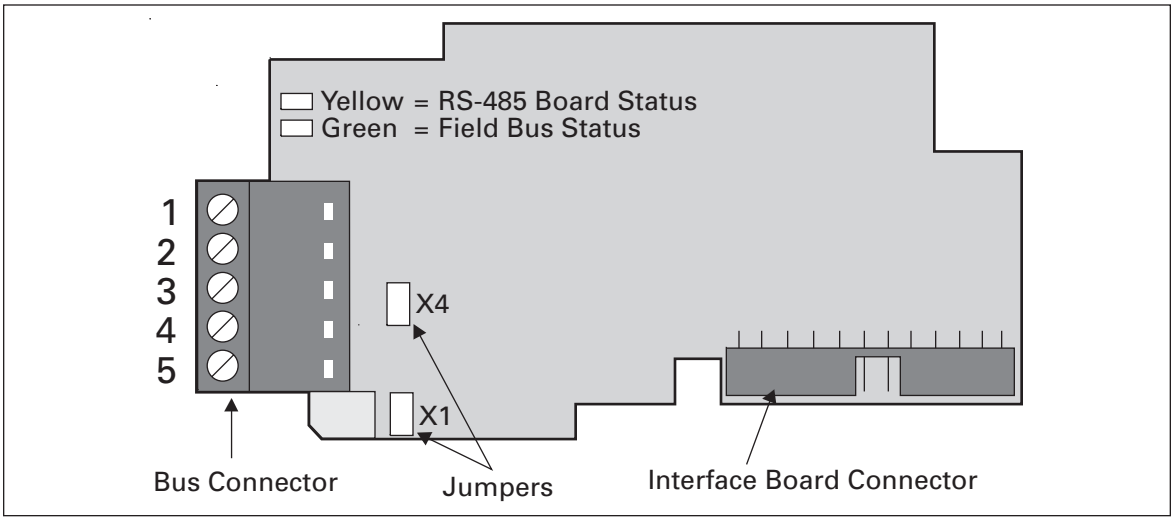
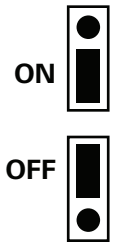



**Figure 2-1: Option Board VS-OPTNX Communication Board**

**Table 2-1: VS-OPTNX Bus Connector Signals**

| Signal | Connector | Description |
|---|---|---|
| SHLD ① | 1 ① | Shield |
| VP | 2 | Supply voltage – plus 5V (not used) |
| - | 3 | Receive/Transmit data – minus (N2-/RT-) |
| + | 4 | Receive/Transmit data – plus (N2+/RT+) |
| COM | 5 | Bus Common (REF/COM) |

① This pin (1) can be used to bypass the cable shield to the next slave.




X4 jumper is the 120Ω termination resistor. Set X4 jumper to ON only if the Johnson Controls N2 Protocol is selected and the drive is the last device on the network. N/A for XT bus communication.

X1 jumper has no effect on VS-OPTNX board.

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# Chapter 3 — Installation

## Making the Communication Bus and Ground Connections

### *Terminating the Ground Wire*

**Note:** Normally, the option board has already been installed in slot D or E of the control board. It is not necessary to detach the whole board to connect the communication bus and ground the bus cable shield. Just detach the terminal block.

1. Strip about 2 in. (5 cm) of the communication cable and cut off the gray cable shield. Remember to do this for both bus cables (except for the last device). See **Figure 3-1**.
2. Strip the individual conductors at about 0.2 in (0.5 cm) to fit in the terminals. See **Figure 3-1**.

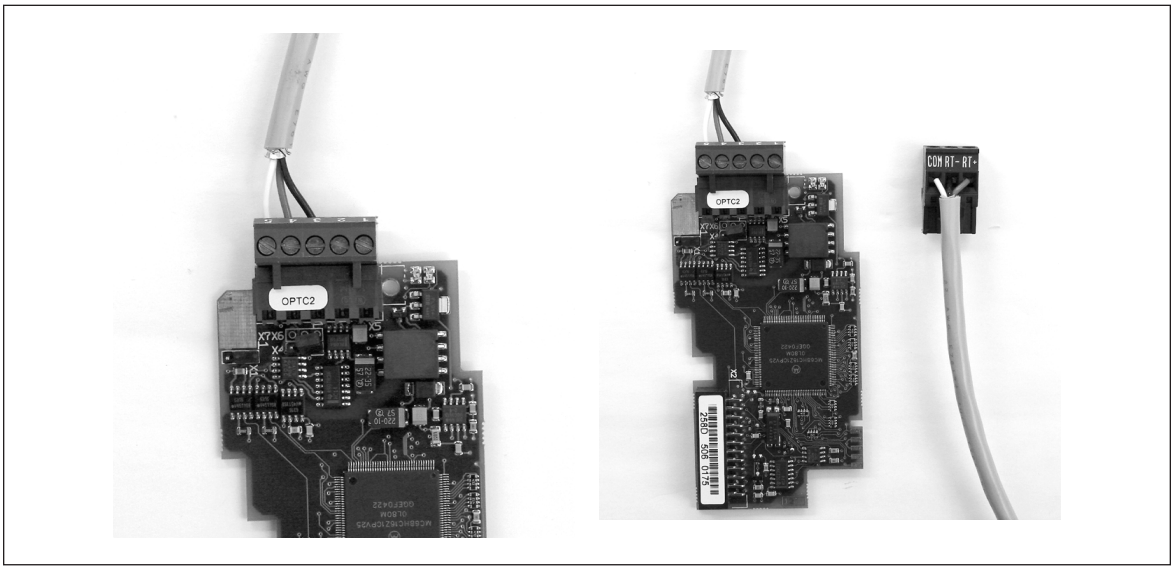



**Figure 3-1: Cable Stripping**

3. Insert the data cables into terminals #3 (-), #4 (+) and #5 (Com.).

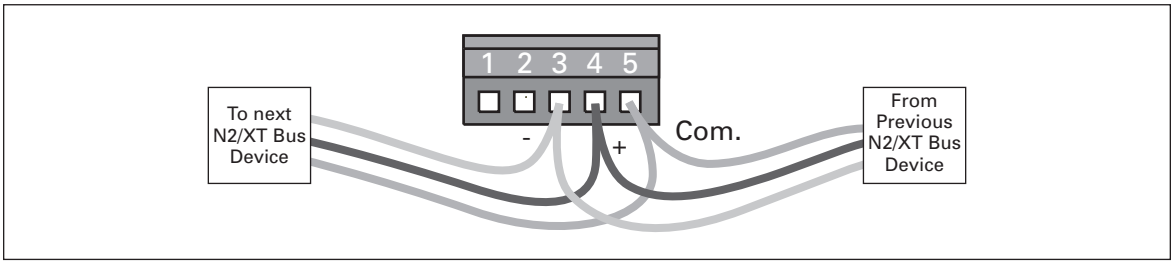



**Figure 3-2: Inserting the Data Cables**

### *Grounding by Clamping the Cable to the Converter Frame*

This method of grounding is the most effective, and especially recommended when the distances between the devices are relatively short.

Strip the communication cable so that it can be secured to the drive frame with the grounding clamp.

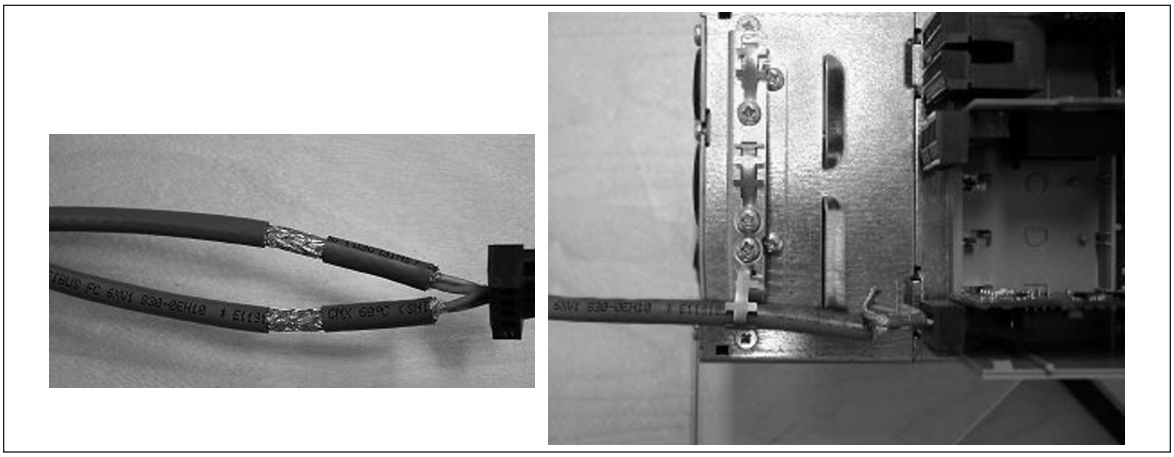


**Figure 3-3: Grounding the Communication Cable**

### *Grounding Only One Point on the Net*

In this method of grounding, the shield is connected to ground only at the last device on the network. Other devices on the network just bypass the shield.

1. Strip about 2 in. (5 cm) of the communication cable and cut off the gray cable shield.
2. Leave no more than 1/4 in. (1 cm) of the cable outside the terminal block and strip the data cables at about 0.5 cm to fit in the terminals. See **Figure 3-4**.

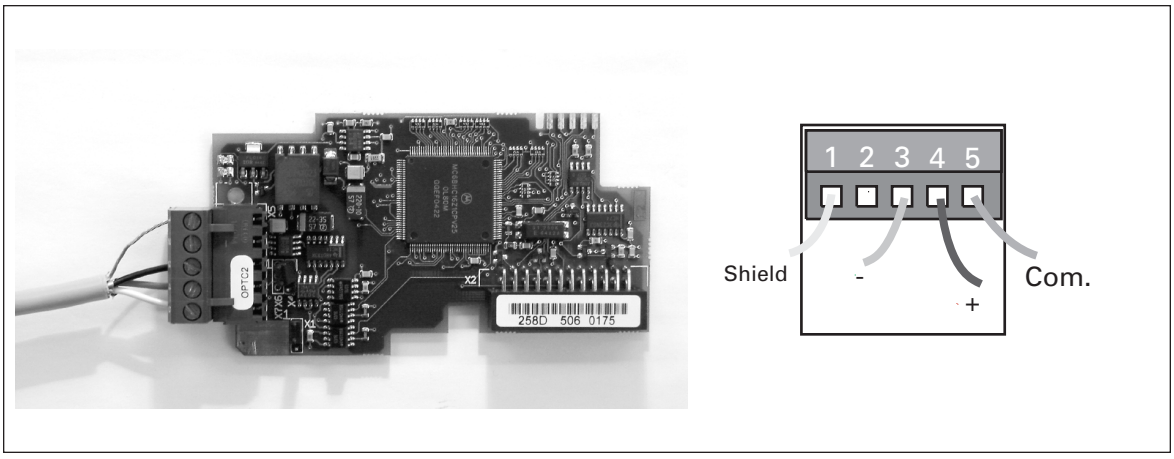



**Figure 3-4: Stripping the Communication Cables**

3. Secure the communication cable to the drive frame with the grounding clamp as shown in **Figure 3-5**.

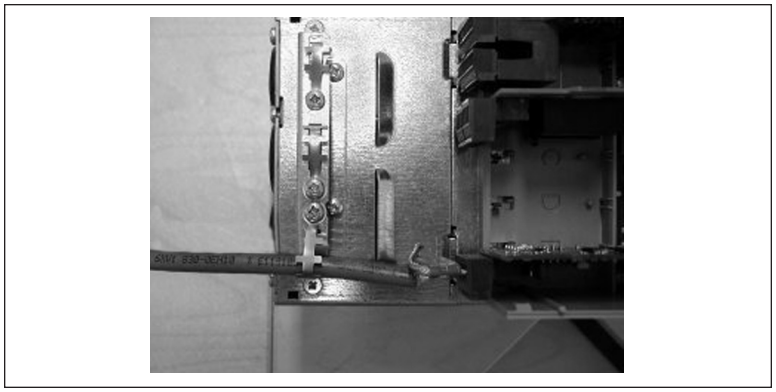


**Figure 3-5: Grounding the Communication Cable**

## Bus Terminal Resistors

If the VS-OPTNX Option Card is programmed for N2 communication and it is the last device on the network, the bus termination must be set to ON. Use jumper X4 (set to the ON position for termination). See **Figure 3-6**.

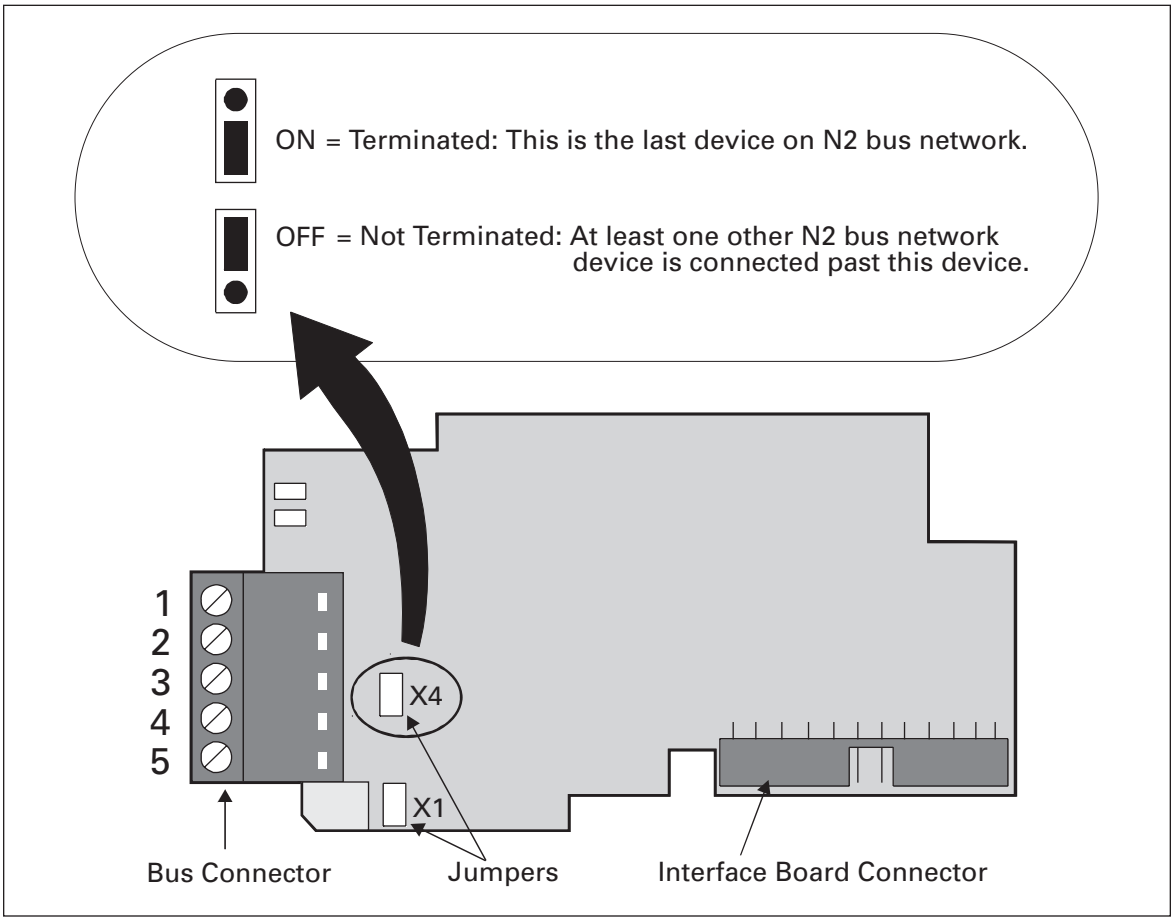



**Figure 3-6: Using Jumper X4 to Set the Bus Termination**

## LED Indications

The two LED indicators next to the connector show the present status of the Communication Board (yellow) and the Fieldbus Module (green).

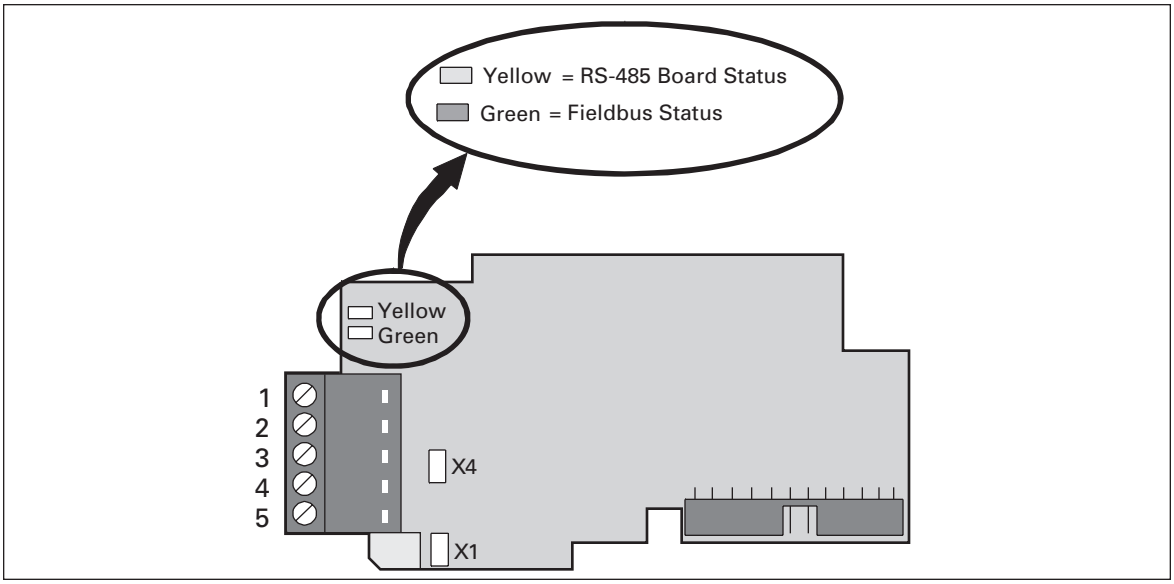



**Figure 3-7: LED Indications on the Communication Board**

**Table 3-1: Communication Board Status LED (BS) — YELLOW**

| LED is: | Meaning: |
|---|---|
| OFF | Option board not activated |
| ON | Option board in initialization state waiting for activation command from the Variable Speed Drive (VSD) |
| Blinking fast (once/sec) | Option board is activated and in RUN state<br>Option board is ready for external communication |
| Blinking slow (once/5 secs) | Option board is activated and in FAULT state<br>Internal fault of option board |

**Table 3-2: Fieldbus Status LED (FS) — GREEN**

| LED is: | Meaning: |
|---|---|
| OFF | Fieldbus module is waiting for parameters from the VSD<br>No external communication |
| ON | Fieldbus module is activated<br>Parameters received and module activated<br>Module is waiting for messages from the bus |
| Blinking fast (once/sec) | Module is activated and receiving messages from the bus |
| Blinking slow (once/5 secs) | Module is in FAULT state<br>No messages from Master within the watchdog time<br>Bus broken, cable loose or Master off-line |

## Installing the VS-OPTNX Communication Board

**Table 3-3: Installing the VS-OPTNX Communication Board**

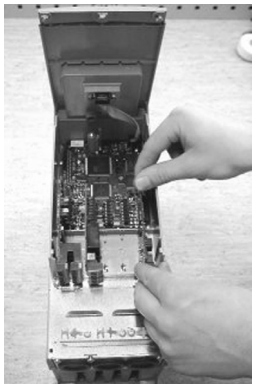
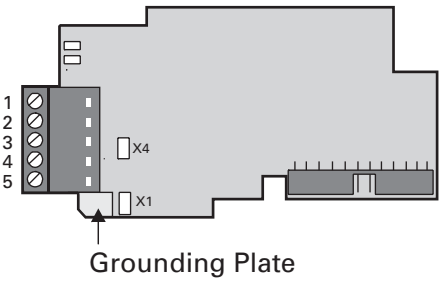
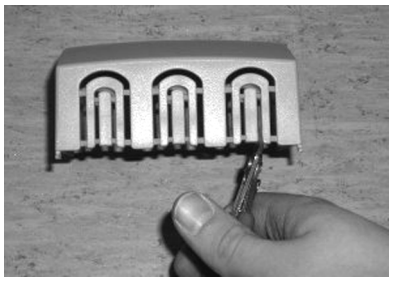
| Procedure | Illustration |
|---|---|
| 1. Remove the cable cover. |   |
| 2. Open the cover of the control unit. |  |
| 3. Install the VS-OPTNXC2 option board in slot D or E on the control board of the VSD. Make sure that the grounding plate (see below) fits tightly in the clamp. |    |

**Table 3-3: Installing the VS-OPTNX Communication Board, continued**

| Procedure | Illustration |
|---|---|
| 4. Make a sufficiently wide opening for your cable by cutting the cover grid as wide as necessary. |  |
| 5. Close the cover of the control unit and the cable cover. |  |

# Chapter 4 — Commissioning

## Fieldbus Board Parameters

The VS-OPTNX RS-485 Communication board is commissioned with the control keypad by selecting values for the appropriate parameters in the Expander board menu M6.

***Expander Board Menu (M6)***

The Expander board menu makes it possible for the user, (1) to see what expander boards are connected to the control board and (2) to view and edit the parameters associated with the expander board. See the step-by-step procedure to commission the RS-485 communication board below.

## RS-485 Communication Parameters

**Table 4-1: Changing the N2/XT Bus Board Commissioning Parameter Values**

| # | Name | Default | Range | Description |
|---|---|---|---|---|
| 1 | Communication Protocol | 1 | 1 – N2 Bus<br>2 – XT Bus<br>3 – SA Bus | Metasys N2 bus communication<br>Metasys DX-9100 XT bus communication<br>Metasys MS/TP BACnet Communications (future) |
| 2 | Slave Address | 1 | 1…247 | |
| 3 | Communication Timeout | 10 | 0 – OFF<br>1 – 300 s | See ***Communication Timeout*** on **Page 4-2** |

The parameters of every device must be set before connecting to the bus. The parameter "SLAVE ADDRESS" must be the same as programmed in the master configuration. (N2 Supervisory System or DX 9100 device.)

***Perform the Following Steps to Commission the RS-485 Communication Board***

- From Operate Menu (◄) (►) to
- Programing Press (enter)
- (▲+) to M6 (Expander boards / G1-G5) (►)
- (▲+) to G6.4 (D:OPTCC / G1-G2) (►) or G6.5 (E:OPTCC / G1-G2) (►)
- G6.4.1 (Parameters P1-P3) (►) or G6.5.1 (Parameters P1-P3)
- P6.4.1.1 or P6.5.1.1 (Comm. Protocol) (►) N2 (enter) , or (▲+) XT (enter) (▲+)

**Note:** If… G6.4 (Slot D: or E: = OPTC2) and P6.4.1.1 or P6.5.1.1 (Comm. Protocol) (►) ModBus, or (▲+) N2, the RS-485 card in the drive is the VS-OPTC2 comm. card not the VS-OPTNX comm. card. The RS-485 comm. card can be reprogrammed with the VS-OPTNX firmware using the 9000X Load software available on the Johnson Controls Portal (or the Exchange website). See the notes on **Page 4-2** or contact JCI Field Support Center for further information.

- P6.4.1.2 or P6.5.1.2 (Slave Address) (►) 1 to 247 (enter) (▲+)
- P6.4.1.3 or P6.5.1.3 (Comm. Timeout) (►) 0 to 10 seconds (enter)
- (◄) To Main Menu
- (▲+) (▼-) to M8 (Operate Mode Press (enter) )

***Procedure to Check the RS-485 Communication Software Revision***

- From Operate Menu (◄) (►) to
- Programing Press (enter)
- (▲+) to M5 (System Menu / S1 – S11) (►)
- (▲+) to S5.8 (System Info / I1 – 17) (►)
- (▲+) to S5.8.6 (Expander boards / E1 – E5) (►)
- (▲+) to E5.8.6.4 (D:OPTCC / E1 – E2) (►) or E5.8.6.5 (E:OPTCC / E1 – E2) (►)
- (▲+) to E5.8.6.4.2 (Program version), or E5.8.6.5.2 (Program version)

**10610.6** = VS-OPTNX software (N2/XT) standard for VSD Series drives (No further action needed).

If the comm. card revision displays …

**10605.3** = VS-OPTC2 (pre-release software N2/XT) or …

**10514.15** = VS-OPTC2 software (ModBus/N2) standard for Eaton drives (Perform the following steps)

**⚠ IMPORTANT**

The RS-485 card must be in option card slot E when running the C2toCC.exe program.

1. Run the executable file "C2toCC.exe" that is required to convert the ID of the RS-485 card so the drive will recognize the comm. card as the VS-OPTNX.
2. Download the System Software (SVX00031V015.vcn).
3. Download the JCI Application Wizard software (JCX0001V215.vcn).
4. Download the RS-485 communication card with the N2/XT protocol file (NXOPTC2_ 10610V006.vcn).

Following these 5-steps will insure your drive is operating with the latest software revisions.

**Note:** Skip Steps 2 and 4 if the VSD Series Drive order was placed on/after January 13, 2006.

***Communication Timeout***

The RS-485 communication board initiates a communication error if communication is broken for as long as defined by Communication Timeout. Communication Timeout is disabled when given the value **0**.

### *Communication Status*

To see the present status of the communication board, enter the Communication status page from the Monitor menu (G6.4.2). See **Figure 4-1** and **Table 4-2**.

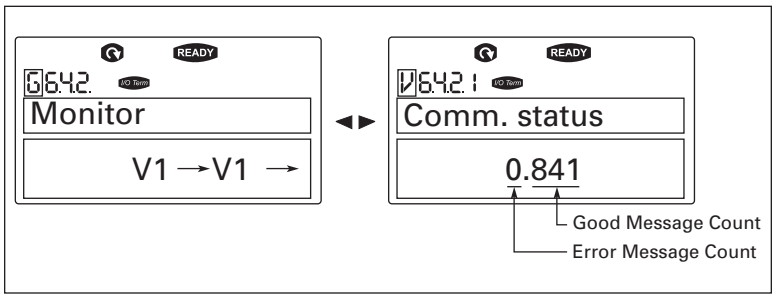



**Figure 4-1: Communication Status**

**Table 4-2: Communication Message Indications**

| Messages | Indications |
|---|---|
| **Good messages** | |
| 0 – 999 | Number of messages received without communication errors |
| **Error messages** | |
| 0 – 64 | Number of messages received with CRC or parity errors |

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# Chapter 5 — Johnson Controls Metasys N2 Protocol

## Overview

The N2 Interface provides:

- Direct control of Drive (e.g. Run, Stop, Direction, Speed reference, Fault reset)
- Full access to necessary parameters
- Monitoring of Drive status (e.g. Output frequency, Output current, Fault code)
- In stand-alone operation, or if the polling is stopped, the overridden values are released after 10 minutes.

### *Analog Input (AI) Features*

All Analog Input (AI) points have the following features:

- Support Change of State (COS) reporting based on high and low warning limits.
- Support Change of State (COS) reporting based on high and low alarm limits.
- Support Change of State (COS) reporting based on override status.
- Always considered reliable and never out of range.
- Writing of alarm and warning limit values beyond the range that can be held by the drive's internal variable will result in having that limit replaced by the "Invalid Float" value even though the message is acknowledged. The net result will be the inactivation of the alarm or warning (the same as if the original out of range value was used).
- The N2 system should be set up to disallow overriding AI points or have an alarm condition activated when a AI point is overridden. Overriding is supported from the standpoint that the "Override Active" bit will be set and the value reported to the N2 network will be the overridden value. However, the value in the drive remains unchanged.
- Overriding an AI point with a value beyond the limit allowed by the drive's internal variable will result in an "Invalid Data" error response and the override status and value will remain unchanged.

### *Binary Input (BI) Features*

All Binary Input (BI) points have the following features:

- Support Change of State (COS) reporting based on current state.
- Support Change of State (COS) reporting based on alarm condition.
- Support Change of State (COS) reporting based on override status.
- Always considered reliable.

The N2 system should be set up to disallow overriding BI points or have an alarm condition activated when a BI point is overridden. Overriding is supported from the standpoint that the "Override Active" bit will be set and the value reported to the N2 network will be the overridden value. However, the value in the drive remains unchanged.

### *Analog Output (AO) Features*

All Analog Output (AO) points have the following features:

- Support Change of State (COS) reporting based on override status.
- Always considered reliable.
- Overriding of the AO points is the method used to change a value. Overriding an AO point with a value beyond the limit allowed by the drive's internal variable will result in an "Invalid Data" error response and the override status and value will remain unchanged. If the overridden value is beyond the drive's parameter limit but within the range that will fit in the variable, an acknowledge response is given and the value will be internally clamped to its limit.
- An AO point override copies the override value to the corresponding drive parameter. This is the same as changing the value on the drive keypad. The value is nonvolatile and will remain in effect when the drive is turned off and back on. It also remains at this value when the N2 network "Releases" the point. The N2 system always reads the current parameter value.

**Note:** The N2 system will not poll the AO point when it is being overridden. In this case, the N2 system will not notice a change in value if the change is made via the keypad. To avoid this scenario, set the point up as a "local control" type and release it once it has been overridden. In this way, the N2 system will monitor the value when not being overridden.

### *Binary Output (BO) Features*

All Binary Output (BO) points have the following features:

- Support Change of State (COS) reporting based on override status.
- Always considered reliable.
- Overriding BO points control the drive. These points are inputs commands to the drive.

When released, the drive's internal value remains at its last overridden value.

### *Internal Integer (ADI) Features*

All Internal Integer (ADI) points have the following features:

- Do not support Change of State (COS) reporting.
- Can not be overridden.

# N2 Point Map

### *Analog Input (AI) Point Map*

**Table 5-1: Analog Inputs (AI)**

| NPT | NPA | Description | Units | Note |
|---|---|---|---|---|
| AI | 1 | Speed Setpoint | Hz | 2 decimals |
| AI | 2 | Output Speed | Hz | 2 decimals |
| AI | 3 | Motor Speed | Rpm | 0 decimal |
| AI | 4 | Load (power) | % | 1 decimal |
| AI | 5 | Megawatt Hours | MWh | Total Counter |
| AI | 6 | Motor Current | A | 2 decimal |
| AI | 7 | Bus Voltage | V | 0 decimal |
| AI | 8 | Motor Volts | V | 1 decimal |
| AI | 9 | Heatsink Temperature | ° C | 0 decimal |
| AI | 10 | Motor Torque | % | 1 decimal |
| AI | 11 | Operating Days | Day | 0 decimal |
| AI | 12 | Operating Hours | Hour | 0 decimal |
| AI | 13 | Kilowatt Hours | kWh | Trip Counter |
| AI | 14 | Torque Reference | % | 1 decimal |
| AI | 15 | Motor Temperature Rise | % | 1 decimal |
| AI | 16 | PID Feedback (Process Variable)<br>(Dependent on PID Application) | " wc/Pa<br>" wc/Pa<br>psi/kPa<br>°F/°C<br>% | — Duct Static<br>— Building Static<br>— Pressure<br>— Temperature<br>— Generic |
| AI | 17 | Open (future use) | — | — |
| AI | 18 | FBDataOut1Sel ① | — | 0 decimal |
| AI | 19 | FBDataOut2Sel ① | — | 0 decimal |
| AI | 20 | FBDataOut3Sel ① | — | 0 decimal |
| AI | 21 | FBDataOut4Sel ① | — | 0 decimal |
| AI | 22 | FBDataOut5Sel ① | — | 0 decimal |
| AI | 23 | FBDataOut6Sel ① | — | 0 decimal |
| AI | 24 | FBDataOut7Sel ① | — | 0 decimal |
| AI | 25 | FBDataOut8Sel ① | — | 0 decimal |

① These analog inputs are application specific. See **Table A-1** on **Page A-1**.

### *Binary Input (BI) Point Map*

**Table 5-2: Binary Inputs (BI)**

| NPT | NPA | Description | 0 = | 1 = |
|---|---|---|---|---|
| BI | 1 | Ready | Not Ready | Ready |
| BI | 2 | Run | Stop | Run |
| BI | 3 | Direction | Clockwise | Counterclockwise |
| BI | 4 | Faulted | Not Faulted | Faulted |
| BI | 5 | Warning | Not Warning | Warning |
| BI | 6 | Ref. Frequency reached | False | True |
| BI | 7 | Motor running at zero speed | False | True |
| BI | 8 | Digital Input Interlock | False | True |
| BI | 9 | Bypass Mode Active | False | True |
| BI | 10 | Digital Input Fire Mode | False | True |
| BI | 11 | Hand Control Mode | False | True |
| BI | 12 | Auto Control Mode | False | True |
| BI | 13 | Control Mode OFF | False | True |

### *Analog Output (AO) Point Map*

**Table 5-3: Analog Outputs (AO)**

| NPT | NPA | Description | Units | Note |
|---|---|---|---|---|
| AO | 1 | Comms Speed | % | 2 decimal |
| AO | 2 | Current Limit | A | 2 decimal |
| AO | 3 | Minimum Speed | Hz | 2 decimal |
| AO | 4 | Maximum Speed | Hz | 2 decimal |
| AO | 5 | Accel Time | s | 1 decimal |
| AO | 6 | Decel Time | s | 1 decimal |
| AO | 7 | FB PI Setpoint ① | % | 2 decimal |
| AO | 8 | FB Actual Value ① | % | 2 decimal |

① These analog outputs are sent to the drive and require Parameter 1.1.15 St Pt source auto to be set to "Fieldbus" for AO-7 and Parameter 1.1.17 PI-Input source to be set to "Fieldbus" for AO-8.

### *Binary Output (BO) Point Map*

**Table 5-4: Binary Outputs (BO)**

| NPT | NPA | Description | 0 = | 1 = |
|---|---|---|---|---|
| BO | 1 | Comms Start/Stop | Stop | Start |
| BO | 2 | Comms Forward/Reverse | Forward | Reverse |
| BO | 3 | Comms Reset Fault | N/A | Reset |
| BO | 4 | Enable Bypass<br>FB FixedControlWord Bit_3 ① | Disable | Enable |
| BO | 5 | Activate FB.DI-3<br>FBFixedControlWord Bit_4 ① | OFF | ON |
| BO | 6 | Activate FB.DI-4<br>FBFixedControlWord Bit_5 ① | OFF | ON |
| BO | 7 | Activate FB.DI-5<br>FBFixedControlWord Bit_6 ① | OFF | ON |
| BO | 8 | Activate FB.DI-6<br>FBFixedControlWord Bit_7 ① | OFF | ON |
| BO | 11 | Pass Through RO-1 | OFF | ON |
| BO | 12 | Pass Through RO-2 | OFF | ON |
| BO | 13 | Pass Through DO-1 | OFF | ON |
| BO | 14 | Activate Fire Mode | OFF | ON |
| BO | 15 | Comms PM Setback | OFF | ON |

① These binary outputs are application specific. These can be used to override DI-2 through DI-6 to the "ON" or "Activated" position.

### *Pass Through Digital and Relay Outputs*

If controlling digital or relay outputs through the fieldbus, set parameters P1.3.6 – P1.3.8 "Not Used" (#0).

### *Internal Integer (ADI) Point Mapping*

**Table 5-5: Internal Integers (ADI)**

| NPT | NPA | Description | Units |
|---|---|---|---|
| ADI | 1 | Active Fault Code | — |

March 2006

# Chapter 6 — Johnson Controls Metasys XT Bus Protocol

## DX-9100 XT Bus

The Metasys DX-9100 Extended Digital Controller can be configured to provide precise Direct Digital Control (DDC) as well as Programmed Logic Control (PLC) for a variety of HVAC applications. The DX-9100 can be used as a stand-alone controller or it can be connected to a Metasys Supervisory System over the N2 communication bus. See the Metasys System 9100 Technical Guide (LIT-6364000) for the complete description of the DX-9100 operation.

The XT bus communication protocol was incorporated into the VS-OPTNX communication card to allow the VSD Series Drive to operate with the Johnson Controls DX-9100 Controller as part of the Enclosed Drive package solution or to interface with a DX-9100 control panel. The interface provides the following benefits:

- Direct control of the drive through the DX-9100 controller (over the XT bus) using the standard programming tools (GX-9100 Software Configuration and the DX Commissioning Point Template Program).
- Full access to necessary parameters for control and monitoring the drive (e.g. Run Command, Speed Reference, Fault Reset, Output Frequency, Motor Speed, and Fault Codes).

The DX-9100 control algorithms and input/output point assignments are defined using the GX-9100 Graphical Configuration Software. (See: *GX9100 Software Configuration Guide*, Lit-6364060) This software is also used to identify the "virtual" VSD Series Drive parameters, just as if you were programming the XT bus to define XT Extension Modules for the purpose of expanding I/O capability. Simply select the "6AI, 2AO" XT module from the GX-9100 program module drop-down menu (see **Figure 6-1**), followed by selecting the "4DI, 4DO" EXP module (see **Figure 6-11**).

Once the XT modules are selected in the GX-9100 graphical software, refer to the XT bus point map (**Tables 6-1** to **6-4**) for the XT input/output definition that aligns with the VSD Series Drive parameters.

See Tables 14 and 15 in the N2 *Integration with the NAE Technical Bulletin* (LIT-1201683) for complete details on mapping DX-9100 points to NAE objects (including tag names, item descriptions, which points are commandable, etc.).

The "Hardware Address" assigned to the XT Extension Module is the "Slave Address" that will be entered when programming the RS-485 communication parameters in the VSD Series drive (see Chapter 4 – Commissioning).

**Note:** A sample DX-9100/XT configuration file of the virtual XT-9100 extension module and XP-9102/XP-9104 expansion modules is available for download from the Johnson Controls portal website at my.johnsoncontrols.com under > Products: Variable Speed Drives. On ABCS *Exchange*, visit Exchange Site > Products > Product Families > Variable Speed Drives.

This will provide the end-user with a starting point for configuring the DX-9100/XT application using the GX9100 Graphical Programming Tool.

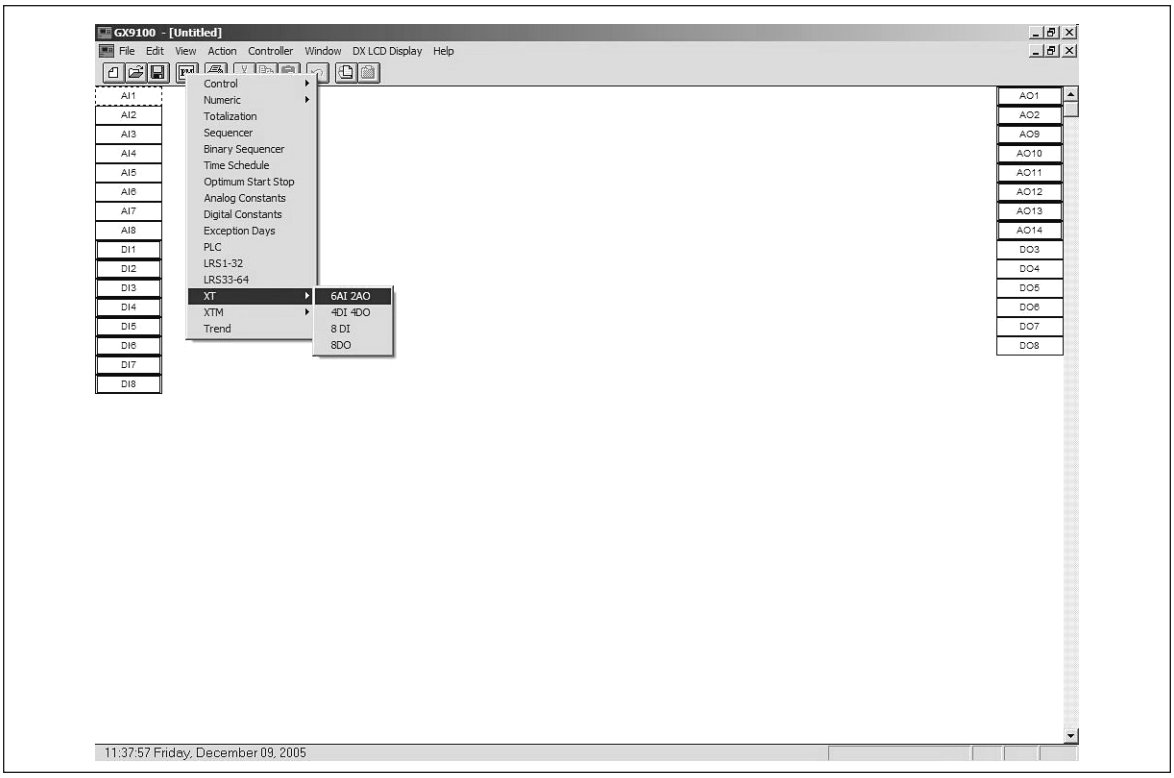


**Figure 6-1: Define VSD Analog Points by Selecting the 6AI, 2AO XT Module**

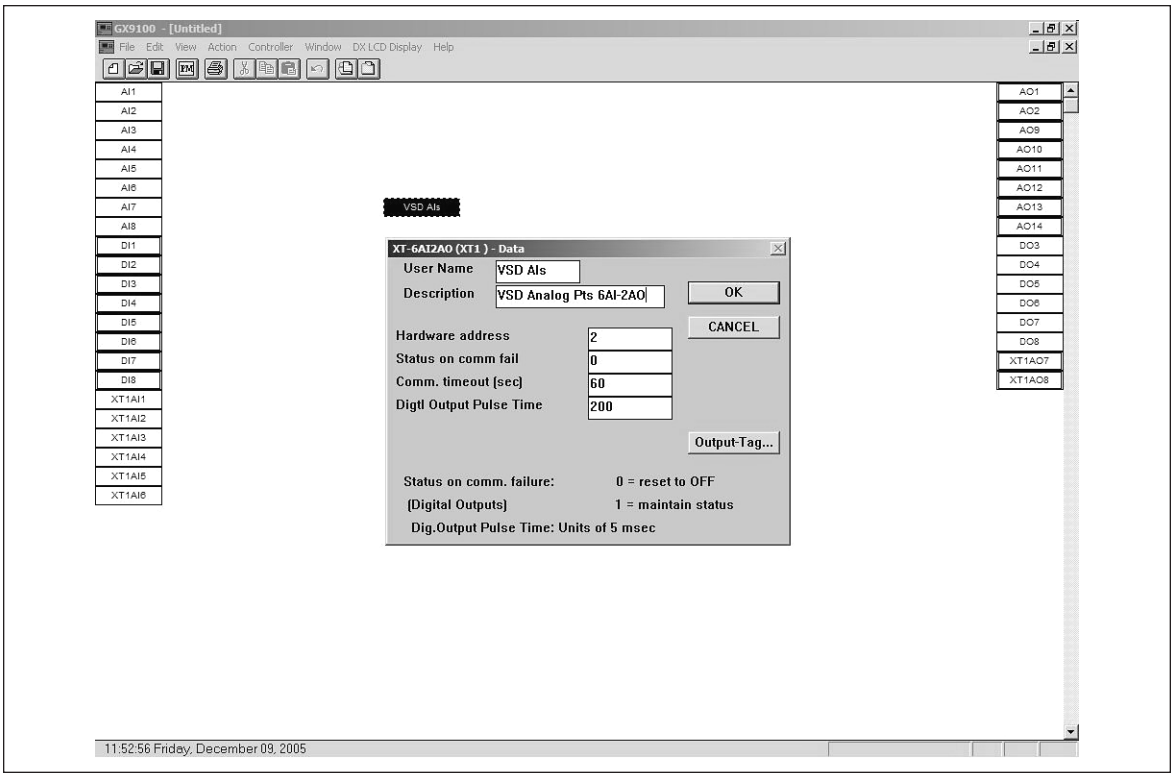


**Figure 6-2: Assign User Names and the Hardware Address for the XT Module**

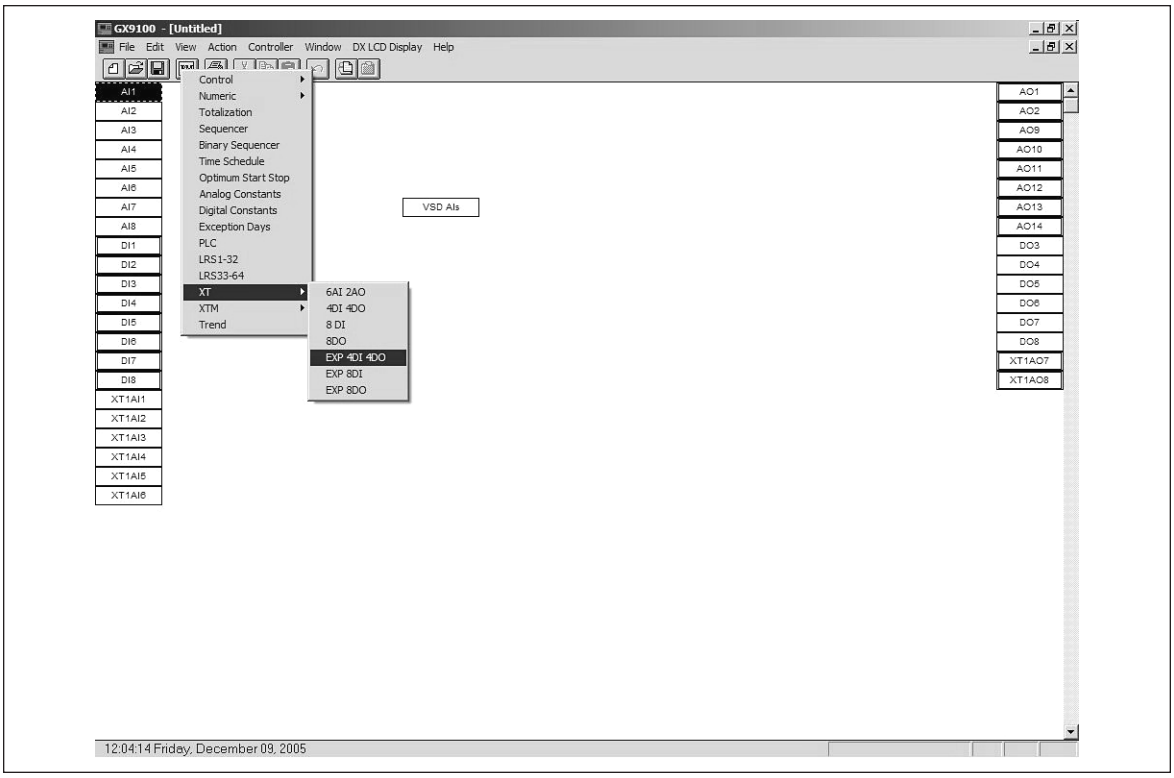


**Figure 6-3: Define VSD Digital Points by Selecting the 4DI, 4DO XT Expansion Module**

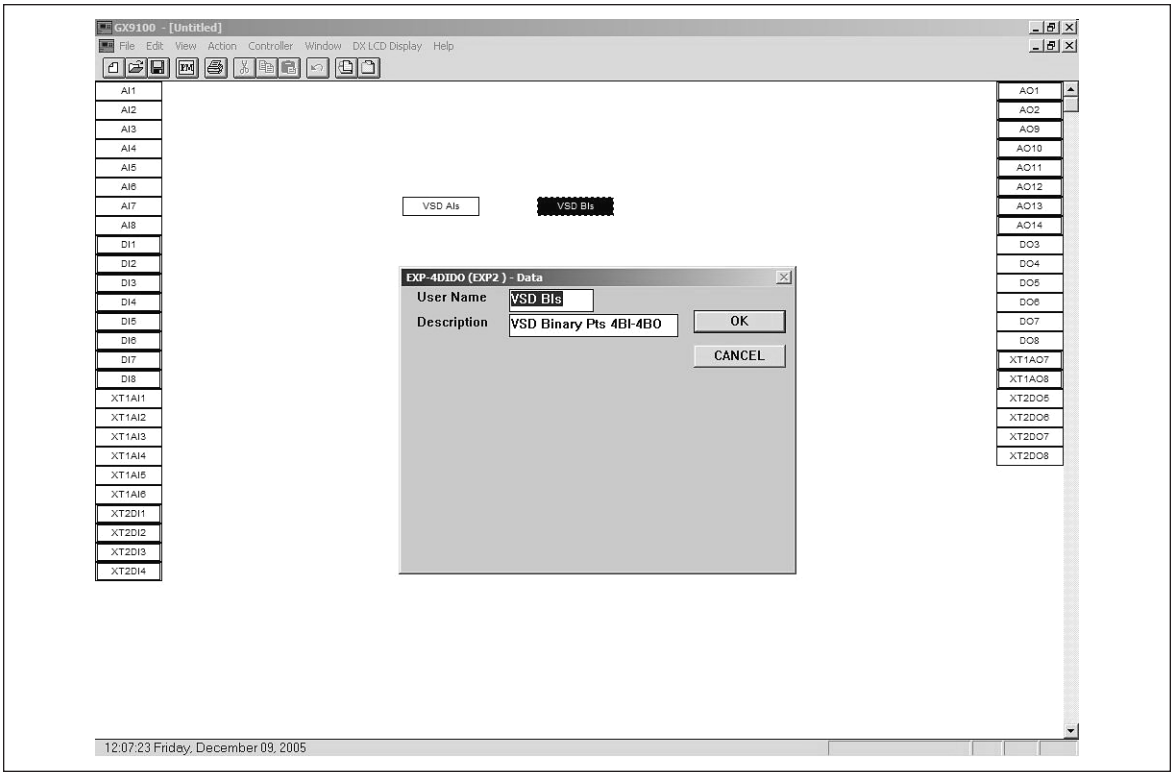


**Figure 6-4: Assign User Names for the XT Expansion Module**

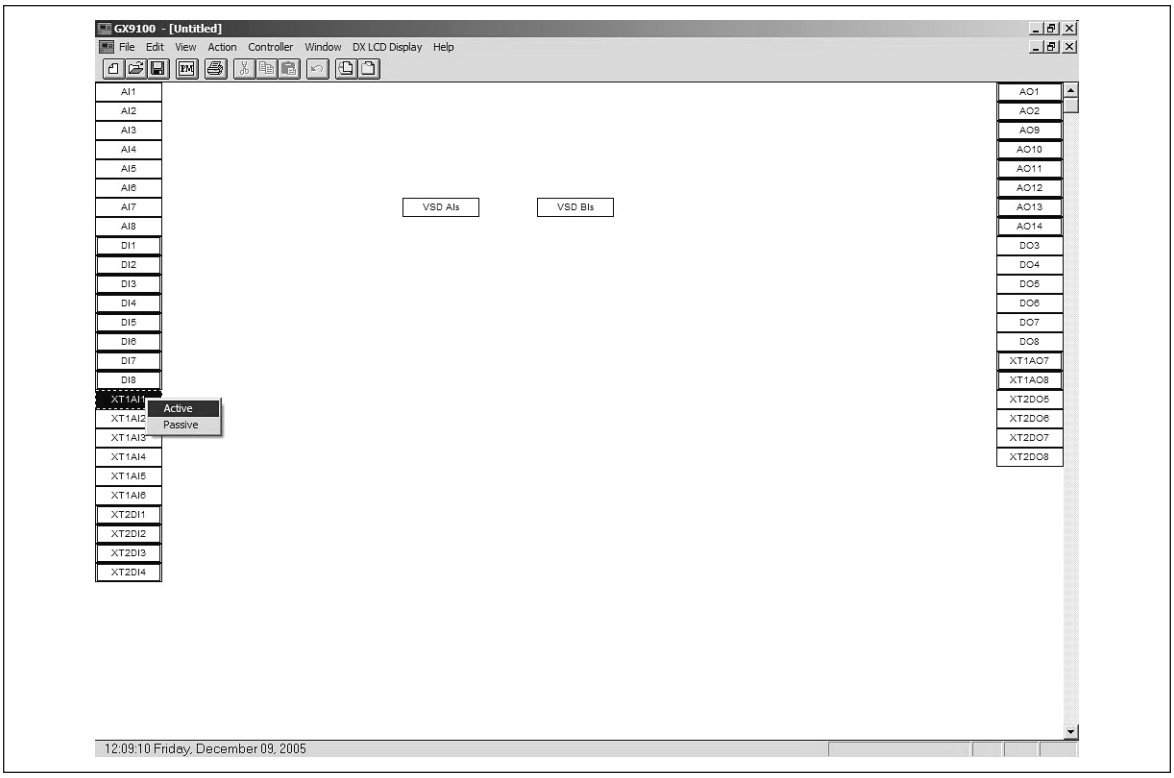


**Figure 6-5: Define All of the VSD/XT Analog Inputs as "Active"**

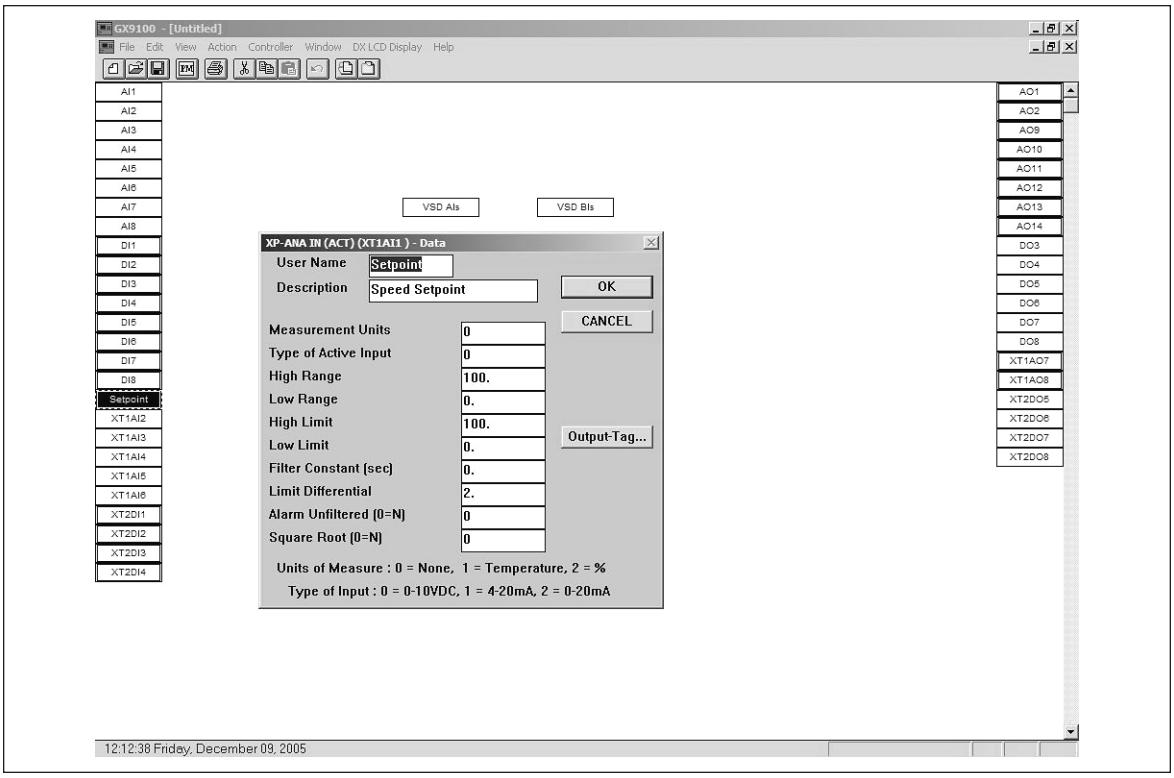


**Figure 6-6: Define the VSD/XT Active Analog Inputs as Noted in Table 6-1**

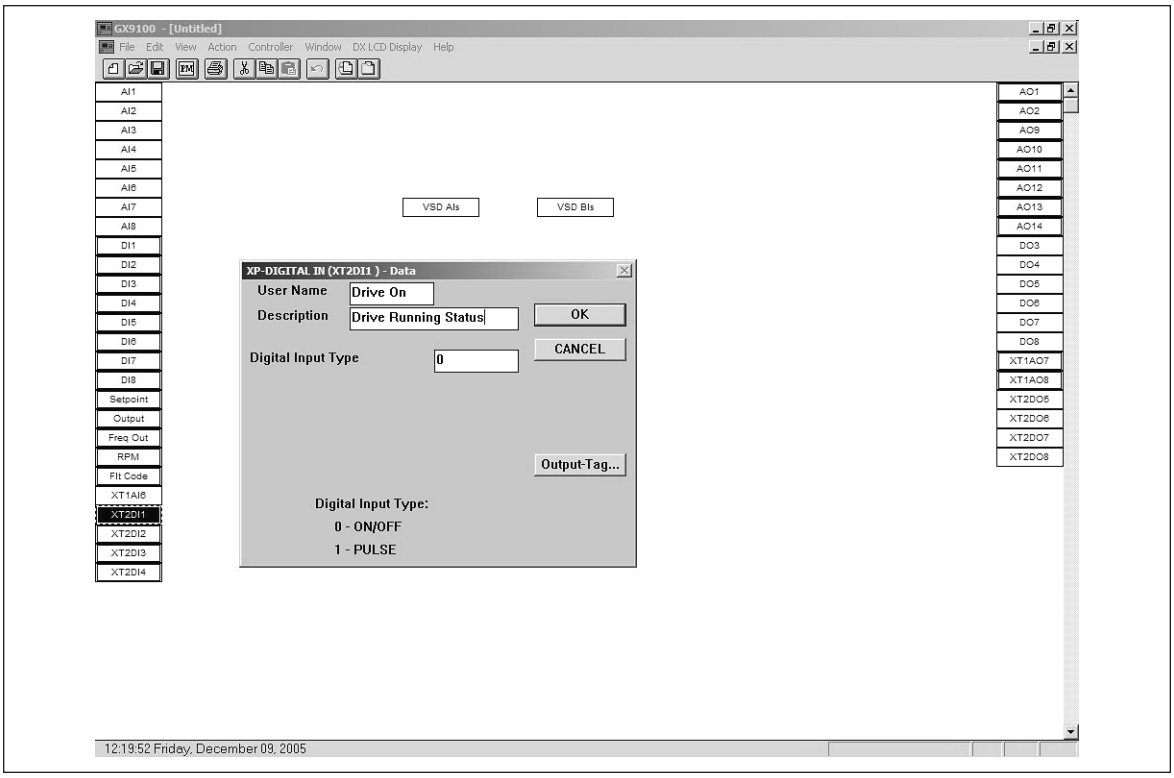


**Figure 6-7: Define the VSD/XT Digital Inputs as Noted in Table 6-3**

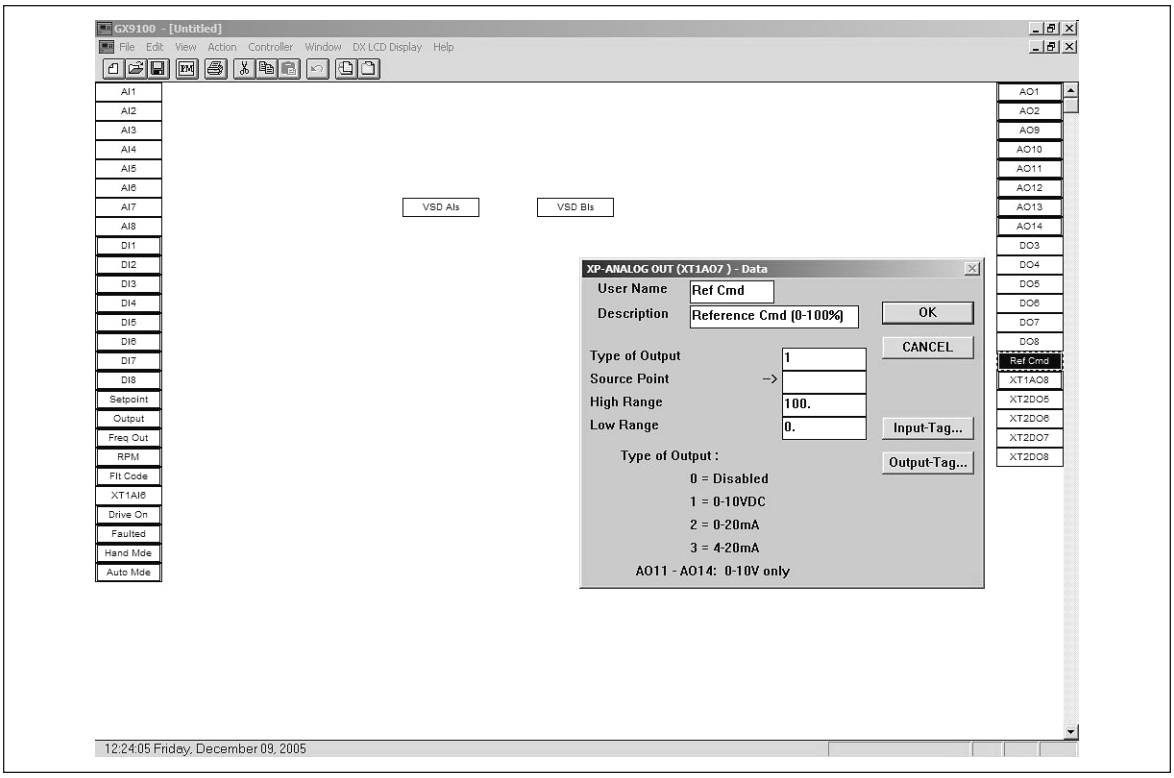


**Figure 6-8: Assign User Names and Define the VSD/XT Analog Outputs as Noted in Table 6-2**

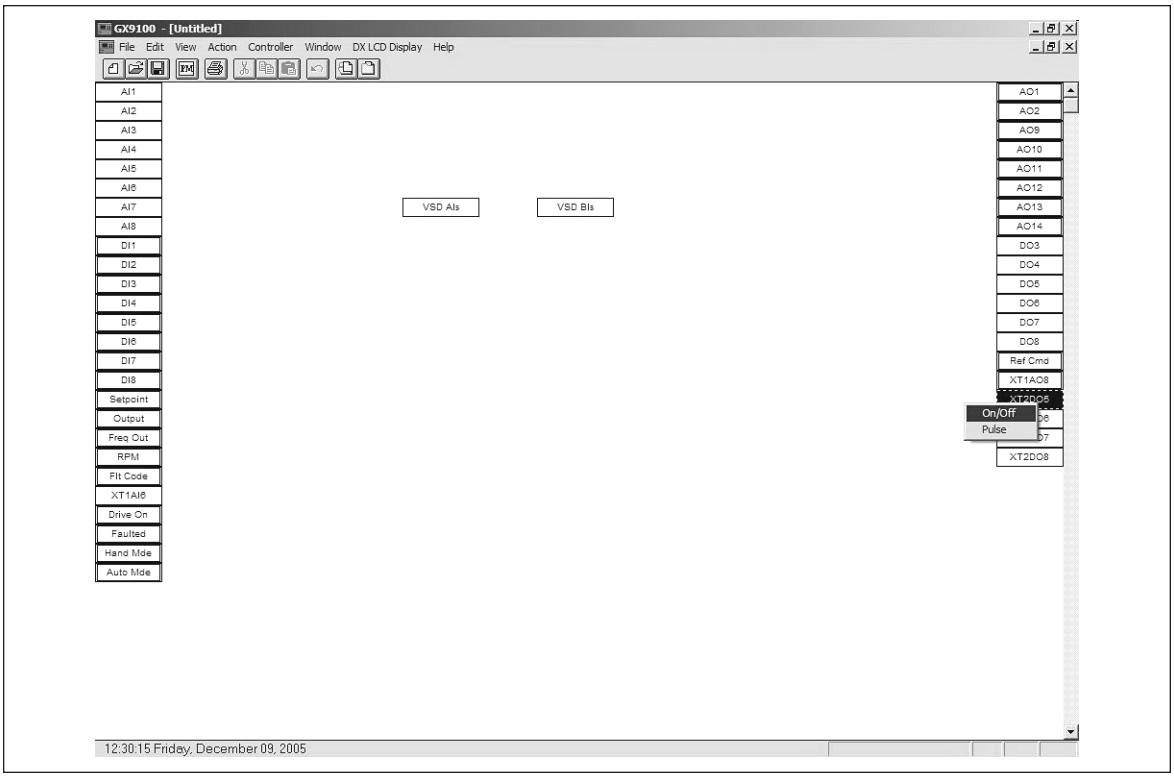


**Figure 6-9: Define the VSD/XT Digital Outputs as ON/OFF Type**

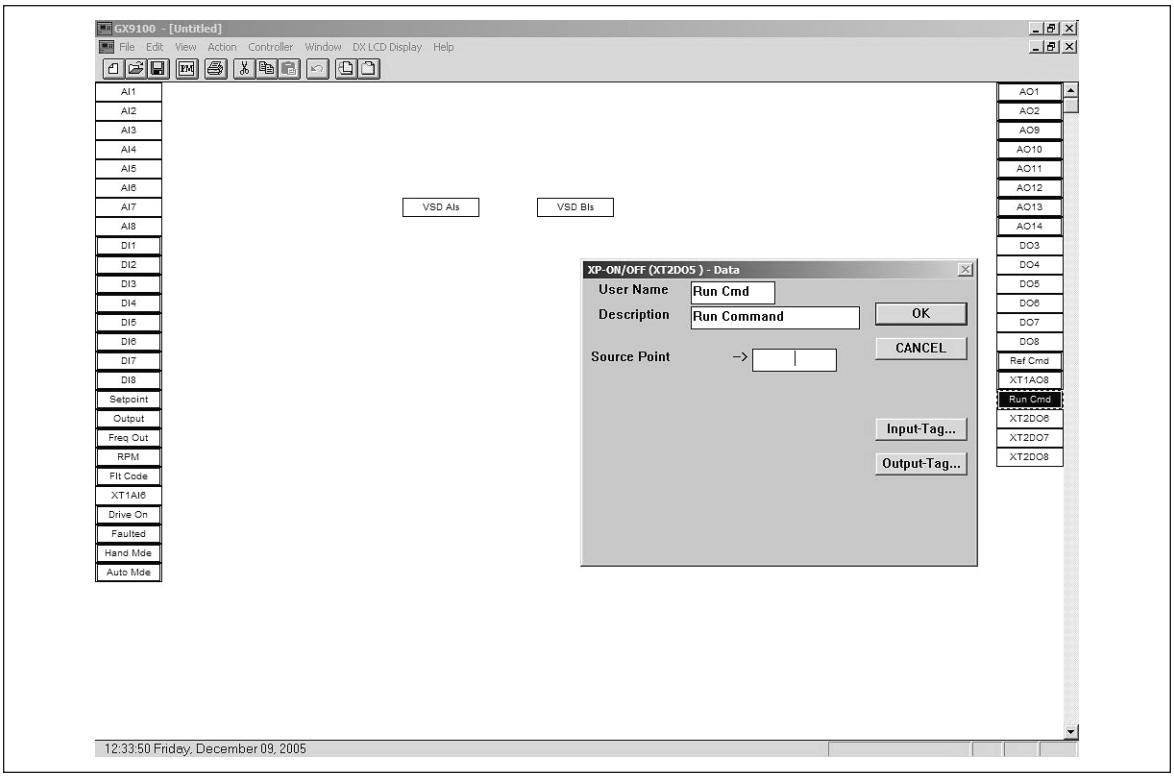


**Figure 6-10: Assign User Names for the VSD/XT Digital Outputs as Noted in Table 6-4**

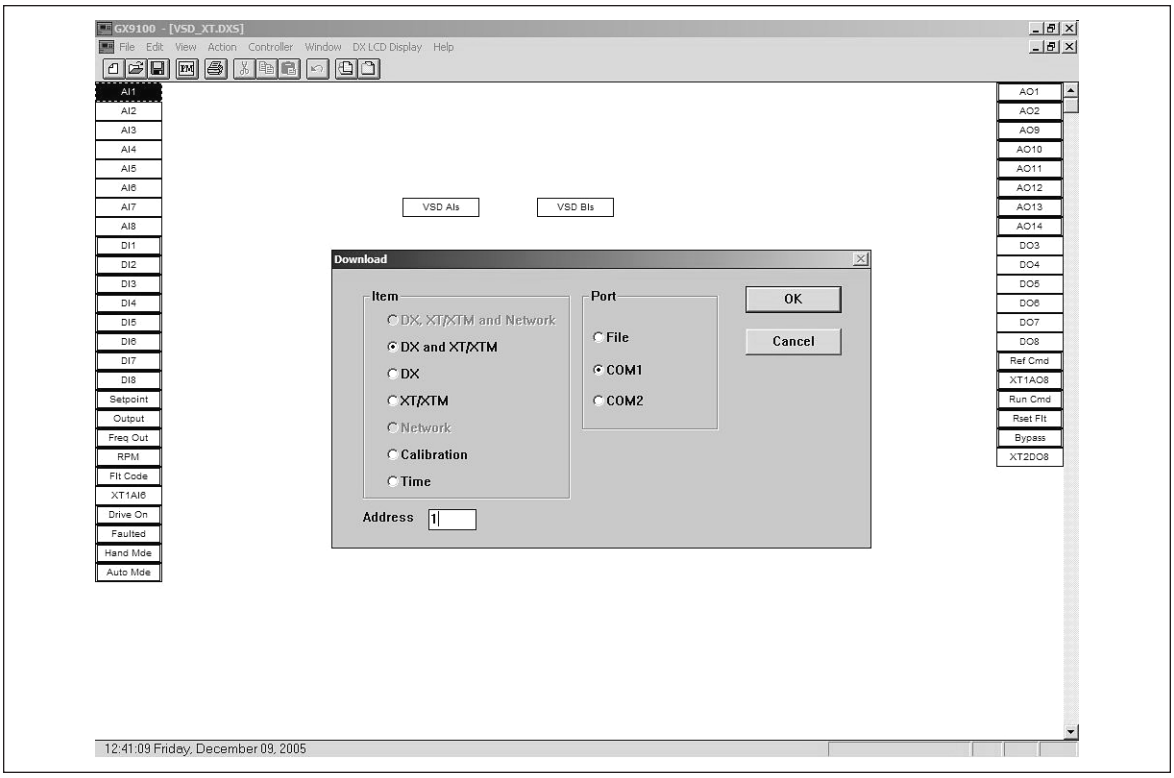


**Figure 6-11: After Saving the File — Download the DX and XT from the "Action" Menu**

# XT Bus Point Map

### *Analog Input (AI) Point Map*

**Table 6-1: Analog Inputs (AI)**

| NPT/NPA | Description | Units | Default |
|---|---|---|---|
| XTxAI1 | Speed Setpoint | % | N.A. |
| XTxAI2 | Output Speed | % | N.A. |
| XTxAI3 | Frequency Output | Hz | N.A. |
| XTxAI4 | Motor Speed | RPM | N.A. |
| XTxAI5 | Fault Code | | N.A. |
| XTxAI6 | Not Used | | |

### *Analog Output (AO) Point Map*

**Table 6-2: Analog Outputs (AO)**

| NPT/NPA | Description | Units | Default |
|---|---|---|---|
| XTxAO7 | Reference (Speed) Command | % | 20% |
| XTxAO8 | Not Used | | |

### *Digital Input (DI) Point Map*

**Table 6-3: Digital Inputs (DI)**

| NPT/NPA | Description | Units | Note |
|---|---|---|---|
| XTxDI1 | Drive Running | On/Off | 1=On=Drive Running |
| XTxDI2 | Drive Faulted | On/Off | 1=On=Faulted |
| XTxDI3 | Hand (Manual) Mode | On/Off | 1=On=Hand Mode |
| XTxDI4 | Auto Mode | On/Off | 1=On=Auto Mode |

### *Digital Output (DO) Point Map*

**Table 6-4: Digital Outputs (DO)**

| NPT/NPA | Description | Units | Note ① |
|---|---|---|---|
| XTxDO1 | Run (Start) Command | On/Off | 1=On=Run |
| XTxDO2 | Reset Fault Command | On/Off | 1=On=Reset Fault |
| XTxDO3 | Bypass Mode | On/Off | 1=On=Bypass Enable ② |
| XTxDO4 | Not Used | | |

① Default = 0.
② Requires the "Run" Command = On to activate the bypass command.

The Reset Fault DO point must be commanded to the OFF state after each occurrence of resetting a fault condition.

# Chapter 7 — Communication Board Fault Tracking

The table below presents the faults related to System Level errors. For more fault code information, see also *VSD Series User Manual* (Fault Tracking Section).

**Table 7-1: Communication Board Faults**

| Fault Code | Fault | Possible cause | Possible solutions |
|---|---|---|---|
| **37** | Device change | Option board changed | Reset |
| **38** | Device added | Option board added | Reset |
| **39** | Device removed | Option board removed | Reset |
| **40** | Device unknown | Unknown option board | Check the installation.<br>If installation is correct contact Johnson Controls Technical Support. |
| **53** | Fieldbus fault | The data connection between the Modbus Master and the Modbus option board is broken | Check the installation.<br>If installation is correct contact Johnson Controls Technical Support. |
| **54** | Slot fault | Defective option board or slot | Check the board and slot.<br>Contact Johnson Controls Technical Support. |

You can define with parameters how the AFD shall react to certain faults:

**Table 7-2: VSD Response to Faults**

| Code | Parameter | Min. | Max | Unit | Step | Default | Note |
|---|---|---|---|---|---|---|---|
| **P2.7.22** | Response to fieldbus fault | 0 | 3 | | 1 | 0 | 0=No response<br>1=Warning<br>2=Fault,stop acc. to 2.4.7<br>3=Fault,stop by coasting |
| **P2.7.23** | Response to slot fault | 0 | 3 | | 1 | 0 | 0=No response<br>1=Warning<br>2=Fault,stop acc. to 2.4.7<br>3=Fault,stop by coasting |

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# Appendix A — Process Data

## Process Data OUT (Slave ➔ Master)

The fieldbus master can read the VSD's actual values using process data variables.

Remote Input, Generic PI, Duct Static, Building Static, Pressure Control and Temperature Control Applications use process data as follows:

**Table A-1: Fieldbus Parameters — M1 ➔ G1.9**

| Code | Parameter | Min. | Max. | Unit | Default | ID Number | Description |
|---|---|---|---|---|---|---|---|
| P1.9.1 | FB Data Out1 Sel | 0 | 10000 | | 1 ① | 1001 | Fieldbus process data output 1 selection.<br>Default = Actual Speed |
| P1.9.2 | FB Data Out2 Sel | 0 | 10000 | | 5 ① | 1002 | Fieldbus process data output 2 selection.<br>Default = Motor Current |
| P1.9.3 | FB Data Out3 Sel | 0 | 10000 | | 8 ① | 1003 | Fieldbus process data output 3 selection.<br>Default = Motor Voltage |
| P1.9.4 | FB Data Out4 Sel | 0 | 10000 | | 7 ① | 1004 | Fieldbus process data output 4 selection.<br>Default = Motor Power |
| P1.9.5 | FB Data Out5 Sel | 0 | 10000 | | 9 ① | 1005 | Fieldbus process data output 5 selection.<br>Default = DC-Link Voltage |
| P1.9.6 | FB Data Out6 Sel | 0 | 10000 | | 20 ① | 1006 | Fieldbus process data output 6 selection.<br>Default = Application Status Word (Variable:ApplStatusWord)<br>**b0** = Drive Ready<br>**b1** = Run Enable<br>**b2** = Drive Running<br>**b3** = Drive Reversing<br>**b4** = General Fault<br>**b5** = General Warning<br>**b6** = Jogging speed (PM Setback) active<br>**b7** = Motor Regulator active<br>**b8** = Output speed supervision indication<br>**b9** = Setpoint speed supervision indication<br>**b10** = HAND Control indication<br>**b11** = AUTO Control indication<br>**b12** = D-IN Firemode<br>**b13** = Damper control signal<br>**b14** = Bypass mode status indication<br>**b15** = Bypass running |

① ID number of parameter or variable to be sent over fieldbus. ID 1 – 20 are Monitoring values, Menu 7 (M7).

**Table A-1: Fieldbus Parameters — M1 → G1.9 , continued**

| Code | Parameter | Min. | Max. | Unit | Default | ID Number | Description |
|---|---|---|---|---|---|---|---|
| P1.9.7 | FB Data Out7 Sel | 0 | 10000 | | 18 ① | 1007 | Fieldbus process data output 7 selection.<br>Default = Active Fault Code |
| P1.9.8 | FB Data Out8 Sel | 0 | 10000 | | 19 ① | 1008 | Fieldbus process data output 8 selection.<br>Default = Active Warning Code |

① ID number of parameter or variable to be sent over fieldbus. ID 1 – 20 are Monitoring values, Menu 7 (M7).

The VSD Series applications have a selector parameter for every Process Data. The monitoring values and drive parameters can be selected using the ID number (see *VSD Series Drives User Manual*, Lit-1201828, Chapter 15 – Description of Parameters, for further definitions).

JOHNSON CONTROLS

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